Effect of ph on growth rate of mung beans

Mung beans are used in several food productions, both as a whole seed and in processed form. According to sprouting expert “ sprout people”, mung beans are most consumed sprout on this planet and are primarily grown in major farmlands in China, Hong Kong and other countries in Asia. Mung beans are widely utilized in Chinese cuisine as well as in the cuisines of Thailand, Japan, Taiwan, Korea and many other countries in Asia. Mung beans grow poorly in both acidic and alkaline environment hence acidic rain could potentially directly affect the growth of mung beans growing under the environment in a long term perspective, this derives the research question.

Secondary research on the profile of mung beans were studied and the optimal pH level for mung beans to grow is pH 6. 2 to 7. 2 and the experiment was designed to investigates in to the effect of pH level of soil (5. 0, 5. 5, 6. 0, 6. 5, 7. 0, 7. 5, 8. 0, 8. 5, 9. 0, 9. 5) on the growth rate of mung beans during a three week experiment, investigating to what extent pH level of soil could affect the growth on mung beans. Growth rate is assessed by measuring and calculating the percentage change for the following indicators: stem height, leaf length, number of leaves.

1 Introduction

The research question is:

“ What is the effect of pH level on the growth rate of mung beans?”

This investigation aims to investigate and analyze the effects of pH on the growth rate of mung beans with a 3 week experiment as 2 weeks is certainly enough time for the mung beans to complete (sprout people) . The purpose is to determine at which pH levels of solution will cause the most growth and at which pH levels slow down or stop the growth of the mung beans. I chose

to use a pH range of 5. 0 – 9. 5 for this experiment as too high or too low pH levels would potentially prevent the plants from growing.

This investigation is composed of secondary researches, analysis of data and experimentation designed to collect data on pH level of soil and the growth rate of mung beans to explain the correlation between pH level and the growth of mung beans. This is substantial as it gives an important scope of the possible result of long term acid rain in Hong Kong because the pH level of acid rain may vary from a pH level of 5. 6 to a low of 4. 5 with the average value of 5. 0 (Charles E. Ophardt). Therefore acid rain can be represented by a solution with a pH level of 5. 0, simulating the effect of acid rain on the growth rate of plants.

2 Investigation

Figure 1 shows the pH scale. For the any plants grow in a healthy condition, certain pH levels are critical to the growth of the plants. These different levels of pH are sure to affect the growth of the plants. For the majority of plants, it is best to have an acidic to neutral pH level (pH 6. 0 to pH 7. 0). Plants are incapable to grow without nutrients which are normally found in soil, if the plants are grown in an acidic soil for example > pH5, the natural nutrients in the acidic soil filtered out of the soil much more rapidly than from soils with the value between 5. 0 and 7. 5. (Leonard Perry, 2003) whereas between 5. 0 and 6. 5, natural nutrients are commonly accessible for the plants. Therefore in this investigation, pH range from 1. 0 to 5. 0 and 9. 0 to 14. 0 that will stop the plant from growing will not be included in this experiment.

Figure 1 shows the pH scale and examples of solution at each pH level. Figure 1 also shows that acid rain has a pH level of around 4. 5 – 5. 0. This theoretically suggests that acid rain could potentially filter out the nutrients in the soil hence decreasing or stopping the growth of the plants as they are unable absorb optimal amount of nutrients in order to grow. Therefore, hypothetically, pH 5. 0 in this experiment will experience very little growth or it will be unable to sustain itself and die in a very short period of time.

2. 1 pH level of solution experiment design

In this experiment, pH level of solution is considered because it is the most important factor required to determine the growth of the mung beans and it was chosen because I want to determine what pH solution is best suited for the growth rate of mung beans as well as to simulate the acid rain in Hong Kong to examine the effect acidic rainfall on the soil and how it affect the growth of mung beans in farmlands. Therefore other independent variables such as temperature and light intensity were excluded from this experiment. In order to record sufficient data on the overall growth rate of the mung beans in this experiment, three parameter including stem height, length of leaves, number of leaves are chosen as dependent variables to identify the possible effects of different pH on the growth the mung beans.

Stem Height: Determine the height of the stem by measuring the height from the border of the pot to the top of the mung bean stem

Length of leaves: Determine the length of leaves by measuring the distance from one end to another end

Number of leaves: Determine the number of leaves by counting the amount of leaves in the mung beans.

Aim, Hypothesis & Variables

3 Aim

The aim of this investigation is to investigate the effects of different pH levels of solution on the growth rate of mung beans

3. 1 Hypothesis

I hypothesize that the mung beans watered with the closest pH level to the optimal pH level for mung beans (pH 6. 2 to 7. 2), the more growth mung beans will gain. Any soil condition below or above the optimal pH level for example 5. 0 – 6. 0 or 7. 5-9. 5 will negatively affect the growth of mung beans. Therefore I also hypothesize the pattern of the curve for the growth rate of mung beans will experience a " Bell Shape" curve.

3. 2 Explanation of Hypothesis

PH level stands for potential hydrogen and the pH level of any solution is the measure of its hydrogen-ion concentration. Mung beans, like most plants are required to absorb nutrients from the soil in order to grow. Soil is a mixture of sand, silt, clay and organic matters. Soil with low pH level will filter out the nutrients needed for the plants to grow therefore the pH level will affect the availability of nutrients for the plants. If the pH level is too acidic, the mung beans cannot absorb as much as nutrients than in pH 6. 2 to 7. 2. Therefore stem height, length of leaves and the number of leaves will decrease at the pH range of 5. 0 – 6. 0, increase at the range of 6. 0 – 7. 0 and decrease at the range of 7. 5 – 9. 5, creating a " bell shape" curve when the data are

plotted on a graph. This is because at pH 6. 0 – 7. 0 is very close to the optimal pH level, the nutrients are not filtered out and therefore there will be more plant nutrients for the mung beans to absorb and grow. Since most growth will be experienced at pH 6. 0 – 7. 0, this will create a " bell shape" curve.

3. 3 Variables

Independent

The pH level of the soil solution with which the mung beans were planted in

Dependent

Measurements to use as indicators of the overall growth of mung beans:

- Stem height
- Length of leaves
- Number of leaves

Controlled

All the mung beans were watered with the same amount of solution, 30ml of pH solution for +each pots because each pot has a volume of 160cm3 and potting expert from flower market recommended 30ml per pot would be the optimal amount.

Same time of the day at the same intervals. (Every two days in the afternoon,

Same watering procedure and the same size watering cans with identical watering technique. (No external water is to come in contact with the plants because the experiment undergo in a dark concealed room.)

UV lamp is used to control the amount of time the light mung beans receive each day, 12 hours (Angela Ryczkowski)

Pots are placed above ground level to minimize contacts with external factors such as external soil or insects

Same type of commercial soil is sued for every pots and each will be filled with the exact same volume of soil

5 trials of each pH solution (To minimize random error)

4 Methods Development and Procedure

Apparatus:

- 70 mung beans
- 50 pots
- Commercial soil
- 30ml pH solution for each pot
- Measuring Cylinder
- Ruler and Pen
- Rubber Gloves
- UV Lamp
- Tub
- Cotton

Experimental Procedure

Firstly all 70 mung beans seed are germinated using the water germination technique. Soaked cottons are put in to the tub to create a layer of wet surface. After 48 hours (sprout people), choose 50 mung beans that have successfully germinated and the length of the root must be at least 0. 4 – 0. 5 cm they are at similar stage. PH solution is use to control the different pH level in the soil and then the beans are then put into the planting pots. According to plotting expert in the flower market, plotting pot with a volume of 160cm3 should be half filled with soil (53 grams) and an additional 10 grams of soil should be sprinkle on top of the seed to create a thin layer that would cover the surface area of the pot and patting down the soil gently. The pots will be labeled according to the pH of the soil that is inside the pot. Each plant will be watered with 30ml of pH solution every two days and measurements were taken every three days. The following measurements will be recorded when the bean starts sprouting and penetrate through the thin layer of soil: stem height, leaf length, and the number of leaves. This experiment will require three weeks watering treatment because mung beans usually require 2 weeks to reach its post germination stage with developed root system and 3 weeks will allow it to reach closer to its maturation stage, therefore if my hypothesis is correct, the trend will be obvious at this stage. The same measurements will be two times a week. With the collected data, create a table that would allow me to construct a graph that can show and analyze the correlation between the pH level in the soil and the growth rate of mung beans.